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AUTOMATED DSL PERFORMANCE ADJUSTMENT

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FIELD OF THE DISCLOSURE

[0001] The present disclosure relates generally to an automated method of adjusting digital subscriber line (DSL) performance and an automated DSL performance control system.

BACKGROUND OF THE DISCLOSURE

[0002] Digital subscriber lines (DSL), such as ADSL lines, are configured to particular profiles based on service agreement, loop quality, and operating environment. A change in these factors, such as introduction of outside electro-magnetic noise, degrades line performance. If the degradation is serious, the line, may become a "problem line" and need a new profile. With a large network, there may be thousands of DSL lines that become problem lines. The typical system to make profile adjustments is to have a service technician manually change the DSL line profile in response to customer complaints received at a volume call center This process may involve one or more truck rolls (sending a service technician to a customer site) which leads to increased DSL maintenance and service costs. It would be desirable to reduce the costs associated with DSL line maintenance while providing improved DSL line performance. Accordingly, there is a need for an improved system and method of adjusting DSL line performance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] FIG. 1 is a block diagram of a DSL network and a DSL control system.

[0004] FIG. 2 is a flowchart of an illustrative method of adjusting DSL line performance.

[0005] FIG. 3 is a flowchart of a detailed method of adjusting DSL line profiles.

DETAILED DESCRIPTION OF THE DRAWINGS

[0006] In a particular embodiment, the present application discloses an automated digital subscriber line performance control system comprising a computer system including a logic module to evaluate performance of a plurality of DSL lines and to automatically select a set of DSL lines from the plurality of DSL lines, a line profile database responsive to the computer system, the line profile database providing a plurality of line profiles in response to a request from the computer system, and a digital subscriber line access multiplexer coupled to the computer system. The digital subscriber line access multiplexer is configured to measure a performance parameter of a plurality of physical DSL lines and to change a profile for at least one of the plurality of DSL lines. The set of DSL lines has degraded performance characteristics based on historical performance data.

[0007] In another embodiment, an automated method of adjusting digital subscriber line (DSL) performance is disclosed. The method includes evaluating performance of a plurality of DSL lines using a computer based system; automatically selecting a set of DSL lines from the plurality of DSL lines, the set of DSL lines having degraded performance characteristics based on historical performance data accessible with respect to the computer based system; retrieving a plurality of line profiles from a profile database; measuring a performance parameter for each of the set of DSL lines; removing from the set of DSL lines any DSL lines that have suitable performance based on the measured performance parameter to create a revised set of DSL lines with degraded performance; and applying one of the plurality of line profiles to each of the physical DSL lines identified by the revised set of DSL lines.

[0008] Referring to FIG. 1, a system in accordance with an embodiment of the present invention is illustrated. The system includes a digital subscriber line (DSL) control system 102, an internet network core 110, and a digital subscriber line access multiplexor (DSLAM) 104. The system also includes a line profile database 108 and a historical DSL performance database 106 coupled to the DSL control system 102. In addition, the system includes a remote web-based reporting terminal 112 coupled to the internet 110. The DSLAM 104 is connected to the internet 110 and connects to a plurality of DSL lines 120 such as illustrated DSL lines 120, 122, and 124. The DSL control system 102 includes evaluation logic 130 and DSL line selection logic 140.

[0009] The DSL control system 102 may be implemented as a computer system that includes software to execute the evaluation logic 130 and the DSL selection logic 140. The web-based reporting terminal 112 may be a computer workstation, or personal computer with a display device that includes an input device and a computer processor. An example is a computer workstation that may be operated by a user for viewing reports as to DSL network performance and statistics. The DSL performance database 106 and the line profile database 108 may be implemented with standard computer database technology.

[0010] Referring to FIG. 2, operation of the system illustrated in FIG.1 is described. At step 202, a problem DSL line selection is made. For example, historical DSL performance data for various DSL lines supported by the DSLAM 104 may be evaluated to determine those DSL lines that have reduced performance or performance below a defined performance threshold. In this manner, one or more problem DSL lines may be selected. Selection logic to determine and evaluate the historical DSL performance data may be performed, such as by using the DSL selection logic unit 104 within the DSL control system 102. DSL performance for various lines is measured, at step 204. This step may be performed on all DSL lines or may be performed just on the reduced set of DSL lines that are identified as problem lines. The measurement of DSL performance made on selected problem lines is performed to confirm that the problem DSL line status through an additional measurement.

[0011] Line profiles for the degraded DSL lines are changed, at step 206. For example, the DSL lines that were initially selected, at step 202, and then verified as having performance problems at step 204, would have their line profiles changed, at step 206. An example of a changed line profile includes a change to a reduced speed profile or to a channel interleaved profile to assist the performance of the problem DSL line selected. A report of the results of problem DSL lines is provided using a web-reporting tool, at 208. For example, a performance measurement of the DSL line may be taken after the profile has been changed. The performance of selected problem DSL lines may be reported both before and after the profile change. A display report may be reported to an operator, such as via the remote web-based reporting terminal 112. In this matter, an operator of a network may observe performance measurements for problem DSL lines and may observe and evaluate those problem DSL lines before and after a change of profile has been made.

[0012] Referring to FIG. 3, a further detailed flow chart that illustrates operation of the system of FIG.1 is shown. Performance of the plurality of DSL lines is evaluated using a computer-based system, at step 302. An example of such a computer-based system would be the DSL control system 102. The set of DSL lines is automatically selected from a plurality of available DSL lines, at step 304. The set of DSL lines having degraded performance characteristics may be determined based on historical performance data that is accessible to the computer-based system, as shown at step 304. For example, historical DSL performance data 106 may be evaluated by the DSL selection logic 104 within the DSL control system 102, with respect to a set of DSL lines supported by DSLAM 104.

[0013] A plurality of line profiles is then retrieved from a profile database, at step 306, and a performance parameter for each of the DSL lines is then measured, at step 308. A subset of DSL lines that have suitable performance based on the measured performance parameter are then removed from the set of degraded DSL lines, at step 310. The result of this step is a revised and reduced size set of DSL lines that have confirmed degraded performance, also shown at step 310. A line profile is then applied to each of the physical DSL lines that are identified by the revised set of DSL lines, at step 312. For

example, a reduced speed profile or an interleaved profile would be applied to each of the physical DSL lines that are identified by the revised set of DSL lines, at step 312. Data associated with the revised set of DSL lines is then stored, at 314. An example of such data would be performance data measured after application of the new line profile to the DSL lines. The stored data is then reported, such as by using a remote internet browsing tool, at step 316. At step 318, an error message is reported if application of the profile to a physical DSL line fails. For example, where a new line profile is attempted to be applied to a physical DSL line and that new line profile is unable to be applied, an error message could be reported at the web-based reporting terminal 112. The error report provides for operator awareness and allows subsequent action to be taken by the operator.

[0014] The system and method illustrated with respect to FIGS. 1-3 above, discloses an automated system and may be used with many DSL lines and multiple DSLAM units in a deployed network. With this automated system, thousands of lines may be measured and adjusted automatically, including periodically or on a scheduled basis. With automated adjustments, human intervention is either not needed or, is significantly reduced. The processing time to measure and adjust each DSL line typically uses less than one minute of computer time. The same operation performed by a service technician manually, could take half an hour or longer, depending on the skill of the technician and the complexity of the DSL problem. In addition, using manual service technicians may result in one or more truck rolls adding further cost to DSL maintenance in the network.

[0015] The disclosed system utilizes automated methods and provides for improved DSL line performance. In addition, the system removes a significant level of human influence in the process and provides for enhanced performance at a lower cost. Further, line profile adjustments is often a difficult and error prone process and is well-suited to an automated computer control technique as shown.

[0016] In addition, with traditional manual methods, only those problem lines identified by customer calls would get attention. In the disclosed system, many problem lines are detected automatically and profiles may be automatically corrected to prevent these problem customer calls. Thus, customer service and DSL line performance is improved

while maintenance costs are further reduced. In this manner, not only are customer complaints taken care of expeditiously, but many problems are fixed where neither the company nor the customer have been formally identified, thus, preventing potential subscriber loses. In addition, using a web-based reporting terminal, reports may be generated that include information, such as a list of problem lines selected, lines that fail in the adjustment process, lines that are adjusted successfully, and a line performance matrix that shows performance before and after the line profile has been applied. Thus, a useful reporting tool for network operators is also provided.

[0017] The above disclosed subject matter is to be considered illustrative, and not restrictive, and the appended claims are intended to cover all such modifications, enhancements, and other embodiments which fall within the true spirit and scope of the present invention. Thus, to the maximum extent allowed by law, the scope of the present invention is to be determined by the broadest permissible interpretation of the following claims and their equivalents, and shall not be restricted or limited by the foregoing detailed description.